Report of the Kew Observatory Committee for the Year ending December 31, 1895.

The operations of The Kew Observatory, in the Old Deer Park, Richmond, Surrey, are controlled by the Kew Observatory Committee, which is constituted as follows :—

Mr. F. Galton, *Chairman.*

Captain W. de W. Abney, C.B., R.E.	Mr. R. H. Scott.
Prof. W. G. Adams.	Mr. W. N. Shaw.
Captain E. W. Creak, R.N.	Lieutenant-General R. Strachey, C.S.I.
Prof. G. C. Foster.	General J. T. Walker, C.B.*
The Earl of Rosse, K.P.	Rear-Admiral W. J. L. Wharton, C.B.
Prof. A. W. Rücker.	

The title of the Committee has been changed during the year at the suggestion of the Council of the Royal Society, with the approval of the Board of Trade. The change consists in the insertion of the word "Observatory" and the omission of the word "Incorporated," so that the new title is in full "The Kew Observatory Committee of the Royal Society."

The work at the Observatory may be considered under the following heads:—

1st. Magnetic observations.
2nd. Meteorological observations.
3rd. Solar observations.
4th. Experimental, in connexion with any of the above departments.
5th. Verification of instruments.
6th. Rating of Watches and Marine Chronometers.
7th. Miscellaneous.

* The Committee regret to announce that General Walker died on February 16, 1896.

I. Magnetic Observations.

The Magnetographs have been in constant operation throughout the year, and the usual determinations of the Scale Values were made in January.

The ordinates of the various photographic curves representing Declination, Horizontal Force, and Vertical Force were then found to be as follows:—

Declinometer: 1 inch = 0° 22′·04. 1 cm. = 0° 8′·7.

Bifilar, January 15, 1895, for 1 inch δH = 0·0280 foot grain units.
„ 1 cm. „ = 0·00051 C.G.S. units.
Balance, January 16, 1895, for 1 inch δV = 0·0276 foot grain units.
„ 1 cm. „ = 0·00050 C.G.S. units.

With regard to magnetic disturbances no very exceptional movements have been registered during the year. Some of the principal variations that were recorded took place on the following days:—

February 8—9, 15; March 13—14; April 11—12; May 10, 29; June 2—3; September 30; October 12—14, 28—29; November 9—12; and December 7—8.

The hourly means and diurnal inequality of the magnetic elements for 1895, for the quiet days selected by the Astronomer Royal, will be found in Appendix I.

The following are the mean results for the entire year:—

Mean Westerly Declination	17° 16′·8.
Mean Horizontal Force.....	0·18278 C.G.S. units.
Mean Inclination	67°23′·8.
Mean Vertical Force	0·43901 C.G.S. units.

Observations of Absolute Declination, Horizontal Intensity, and Inclination have been made weekly as a rule.

A Richard Thermograph has been placed in the Magnetograph Room in order to compare its readings with the observed readings of the Thermometer under the Vertical Force shade, and also to obtain a continuous record of the temperature of the room throughout the year.

As in 1894 a Table of recent values of the Magnetic Elements at the Observatories whose publications are received at Kew was contributed to the July number of 'Science Progress.' As this seems to meet a recognised want, the Committee have decided to go further in the same direction, and to publish a similar table annually in their Report (see Appendix Ia). In some cases the results are direct

transcripts from the official publications; in others they are deduced from the recorded monthly or quarterly means. In a few instances figures have been supplied by directors of observatories in answer to special requests.

With the consent of the Committee an analysis of the Declination and Horizontal Force results for the selected "quiet days" of the five years 1890 to 1894, extracted from previous Reports, with additional results required for a complete discussion, was drawn up by the Superintendent, and appears as the Report of 'the B. A. Committee for the Comparison and Reduction of Magnetic Observations,' Ipswich, 1895.

Professor Rücker and Mr. W. Watson spent some time at the Observatory in July and October, comparing their magnetic instruments with the Kew Unifilar and Dip Circle, on behalf of the B. A. Committee for the Comparison of Magnetic Instruments (B.A. Report, 1895, p. 79).

Captain Schück visited the Observatory in June, and made a series of observations in order to compare his own instruments with those of Kew.

The Magnetic Instruments have been studied, and a knowledge of their manipulation obtained by Captain Field, Commander Cust, and Lieutenant Dawson, of the Royal Navy.

Information on matters relating to various magnetic data have been supplied to Mr. Veeder, Captain Schück, and Professor Rücker.

II. Meteorological Observations.

The several self-recording instruments for the continuous registration of Atmospheric Pressure, Temperature of Air and Wet-bulb, Wind (direction and velocity), Bright Sunshine, and Rain, have been maintained in regular operation throughout the year, and the standard eye observations for the control of the automatic records duly registered.

The tabulations of the meteorological traces have been regularly made, and these, as well as copies of the eye observations, with notes of weather, cloud, and sunshine, have been transmitted, as usual, to the Meteorological Office.

With the sanction of the Meteorological Council, data have been supplied to the Council of the Royal Meteorological Society, the Institute of Mining Engineers, and the editor of 'Symons's Monthly Meteorological Magazine.'

Anemograph.—A considerable number of experiments made to check the correctness of the wind vane by comparison with a flag

led to no certain conclusion. It only appeared that if any error existed it must be small.

Electrograph.—The performance of this instrument throughout the year has not been satisfactory. Some twenty-seven days' records were lost in January and February through stoppage by the frost, and for about forty-five days in July and August the instrument was out of action. Towards the end of the year the performance was generally unsatisfactory. After a good deal of fruitless investigation as to causes affecting the scale value, the insulation in the quadrant electrometer and the water-dropper can, the defect has been traced to a gradual deterioration in the insulation of the wire connecting the can with the electrometer. Action is contemplated which will reduce in future the chance of such a misadventure.

On June 11 the instrument was dismounted, old acid removed, and a new suspension, with almost parallel sides, fitted up in order to widen out the scale.

Determinations of the scale value were made on April 5, May 28, June 11, and November 27 by direct comparison with the Portable Electrometer, White 53.

This latter instrument was sent to White, of Glasgow, in December, 1894, to have a new torsion suspension fitted, and to be generally overhauled.

After its return from the maker the value of its scale was kindly determined by Professor Carey Foster at University College Laboratory, and the mean value for one division found to be 290 volts, and this new value has been employed in obtaining the scale-figures for the self-recording instrument.

Inspections.—In compliance with the request of the Meteorological Council, the following Observatories and Anemograph Stations have been visited and inspected:—Radcliffe Observatory (Oxford) by Dr. Chree; Stonyhurst, Armagh, Valencia, Fleetwood, Falmouth, and Dublin by Mr. Baker; and Yarmouth, North Shields, Alnwick Castle, Fort William, Glasgow, Aberdeen, and Deerness (Orkney) by Mr. Constable.

III. Solar Observations.

Sun-spots.—Sketches of Sun-spots have been made on 159 days, and the groups numbered, after Schwabe's method.

Particulars will be found in Appendix II, Table IV.

IV. Experimental Work.

Fog and Mist.—The observations of a series of distant objects, referred to in the last Report, have been continued. A note is taken

of the most distant of the selected objects which is visible at each observation hour.

Atmospheric Electricity.—The series of eye observations commenced last year with a Portable Electrometer at certain points in the immediate neighbourhood of the Observatory have been continued. The results arrived at seem interesting in themselves, and are likely to prove of service in interpreting and checking the records obtained with the water-dropper and electrograph.

Aneroid Barometers.—The apparatus referred to in last Report was delivered by the maker, Mr. J. Hicks, early in the year, and a large number of experiments have been made and reduced; the results have not yet been published.

Nocturnal Radiation.—Regular observations of two minimum thermometers freely exposed on grass, having shown that a constant lowering of their zeros had been taking place for some years; two other minimums have been obtained, and the four instruments are now being daily observed under similar conditions. It is believed that this lowering of zero is mainly caused by the exposure of the bulbs to strong sunshine during summer.

Thermometry.—A set of French hard glass thermometers, standardised at the Bureau International, have been obtained, together with a hypsometer of the Sèvres pattern, constructed under the direction of Dr. Guillaume. Some preliminary comparisons have been made between the French thermometers and some Kew standards at temperatures between the freezing point of mercury and 100° C.

Platinum Thermometry.—This subject has of late years come into prominence mainly through the memoirs* of Professor Callendar and Mr. E. H. Griffiths. The conclusion they have reached is that supposing "platinum temperature," pt, be defined so that its equal increments answer to equal increments in the electrical resistance of a pure platinum wire, the formula

$$t - pt = \delta\{(t/100)^2 - (t/100)\},$$

where t is temperature on the air scale, and δ a constant—for a particular sample of wire—holds, with at least a close approach to accuracy, throughout a wide range of temperature. The convenience of platinum thermometers for measurements of high temperatures has been independently testified to by Messrs. Heycock and Neville in their extensive researches in connexion with the freezing points of metals and alloys.† Even in dealing with ordinary temperatures the advantage possessed by a platinum thermometer, that it may be read at a distance from the spot where the temperature is measured,

* 'Phil. Trans. A.,' 1887, p. 161; 1891 pp. 43 and 119; 1893, p. 361, &c.

† 'Transactions Chemical Society,' 1895 p. 161.

would seem important in many cases, *e.g.*, in observations on earth temperatures.

Taking the above facts into consideration, the Committee decided to instal platinum thermometers at Kew, and to institute an independent series of experiments into their behaviour. Attention will in the first instance be directed more especially to the question of the fixity of the zero and of the fundamental interval. A grant of £100 was obtained from the Government Grant Committee, for the purchase of platinum thermometers, and the other necessary apparatus. A new room has been built for the purpose of the inquiry, from designs by Mr. W. N. Shaw and Mr. E. H. Griffiths, at a cost of over £120. Mr. Griffiths also kindly superintended the construction of the apparatus by the Cambridge Scientific Instrument Company, and along with Mr. C. T. Heycock he visited the Observatory for some days in October, and illustrated the use of the platinum thermometers, and the reduction of the observations. A full account of the apparatus has been given by Mr. Griffiths in 'Nature,' November 14th, 1895.

Hitherto at Kew the examination of mercury thermometers at temperatures above 100° C. has been limited to calibration. This supplies trustworthy knowledge as to the uniformity of the bore and the graduations, but throws no light on the suitability of the glass for exposure to high temperatures. It is also inapplicable to those high range thermometers in which there is gas, at high pressure, above the mercury column. The Committee hope that means will shortly be devised for direct comparison of thermometers at high temperatures, and expect that the platinum thermometers will incidentally prove useful for this purpose.

V. Verification of Instruments.

The subjoined is a list of the instruments examined in the year 1895, with the corresponding results for 1894:—

	Number tested in the year ending December 31.	
	1894.	1895.
Air-meters	4	5
Anemometers	2	7
Aneroids	48	254
Artificial horizons	31	15
Barometers, Marine	119	151
,, Standard	66	64
,, Station	12	25
Binoculars	417	376
Compasses	64	244
Deflectors	1	20
Hydrometers	289	187
Inclinometers	3	4
Photographic Lenses	27	14
Magnets	14	2
Navy Telescopes	249	456
Rain Gauges	6	9
Rain Measures	10	90
Scales	—	4
Sextants	461	532
Sunshine Recorders	1	0
Theodolites	4	7
Thermometers, Arctic	51	114
,, Avitreous or Immisch's	28	39
,, Chemical	64	34
,, Clinical	15,593	16,699
,, Deep sea	35	125
,, Meteorological	3,225	2,647
,, Mountain	23	25
,, Solar radiation	2	3
,, Standard	74	81
Unifilars	7	4
Vertical Force Instruments	6	34
Total	20,936	22,271

Duplicate copies of corrections have been supplied in 46 cases.

The number of instruments rejected on account of excessive error, or for other reasons, was as follows :—

Thermometers, clinical	195
,, ordinary meteorological	48
Sextants	83
Telescopes	10
Various	38

Two Standard Thermometers have been supplied during the year.

There were at the end of the year in the Observatory undergoing verification, 10 Barometers, 533 Thermometers, 12 Sextants, 4 Hydrometers, 4 Anemometers, 2 Air Meters, 2 Rain Gauges, and 2 Rain Measures.

VI. Rating of Watches and Chronometers.

The high standard of excellence to which attention was drawn in last year's Report has been fully maintained, and there has been an increase not only in the number of movements entered for the class A trial, but also in the number of watches which have obtained the highest possible form of certificate—the class A especially good—(involving the attainment of 80 per cent. of the total marks), no less than 59 being so classed.

The 746 watches received were entered for trial as below :—

For class A, 435 ; class B, 207 ; class C, 92 ; and 12 for the subsidiary trial. Of these 10 passed the subsidiary test, 129 failed from various causes to gain any certificate ; 62 were awarded class C certificates, 190 class B, and 355 class A.

In Appendix III will be found a table giving the results of trial of the 59 watches which gained the highest number of marks during the year. The first place was taken by A. E. Fridlander, Coventry, with a keyless, going-barrel, lever-watch, No. 13,911, which obtained 87·4 marks out of a maximum of 100.

Marine Chronometers.—During the year 58 chronometers have been entered for the Kew A and B trials, of which 52 were certificated, and 6 failed to pass.

Considerable difficulty was experienced during the autumn in regularly maintaining the temperature of the watch oven at about 90° F., and to overcome this, a new gas boiler—by Fletcher and Company, Warrington—has been fitted up, to replace the old tubular heating apparatus, which had become much worn. The opportunity was taken to have a new water-tight cover made, and the non-conducting packing material was also renovated.

A new draw-off pipe and cap have been fitted to the refrigerator, to prevent any accumulation of water from the melting ice.

The seconds contact pieces on the mean-time standard clock having become much worn, the clock has been sent to Dent & Co., to be put in thorough order, and to have their electric contacts fitted. When ready it will be fixed in a new position in the South Hall, where the temperature is very steady.

The mean-time clock Dent 2011, kindly lent to the Committee by the Astronomer Royal, is being used during the interval.

VII. Miscellaneous.

Paper.—Prepared photograph paper has been supplied to the Observatories at Hong Kong, Mauritius, St. Petersburg, Oxford (Radcliffe), and Stonyhurst, and through the Meteorological Office to Aberdeen, Batavia, and Fort William.

Anemograph and Sunshine Sheets have also been sent to Hong Kong and Mauritius.

A portable electrometer (White, No. 77) has been procured and forwarded to Mauritius.

Exhibition at Imperial Institute.—A selection of photographic curves from the various self-recording instruments, along with cloud photographs and specimens of early daguerrotypes were shown during the summer at the exhibition of photography at the Imperial Institute. The chairman and superintendent were included in the Committee of Advice.

Pendulum Apparatus.—The apparatus sent out to Melbourne in 1892 has been returned, and is now being repaired by Mr. P. Adie. The air pump is receiving a new frame, and the dummy pendulum a new brass shaft and fittings.

House, Grounds, and Path.—These have been kept as usual throughout the year. The road leading from Richmond to the Observatory was extended inside the new enclosure, the fencing of which was completed early in the year. The expense was defrayed out of the balance of Extension Fund brought forward from last year.

To meet an increased demand for gas, a new and larger main has been laid between the Observatory and the building outside, which contains the platinum thermometer room and clinical thermometer testing apparatus. Simultaneously a larger meter and new gas governors were fitted up in the Observatory.

First Assistant Director at Mauritius Observatory.—At the request of the Colonial Office, the Committee undertook the task of selecting and recommending a candidate for the post of First Assistant Director at the Royal Alfred Observatory, Mauritius. Their choice fell on Mr. J. Folkes Claxton, previously engaged in the Meteorological and Magnetic Department of the Royal Observatory, Greenwich, and their nomination was approved by the Colonial Office. Subsequent to his appointment in December, Mr. Claxton spent a few days at the Observatory to familiarise himself with the patterns of meteorological and magnetic instruments in use at Kew.

At the request of the Acting Director of the Central Physical Observatory at St. Petersburg, submitted through the Meteorological Council, an account of the Observatory, dealing more especially with its functions as a meteorological station, along with plans

of the building and its surroundings, has been drawn up by the Librarian. This is ultimately to be contributed to the meteorological section of an exhibition to be held at Nijni Novgorod in 1896.

Library.—During the year the library has received publications from—

31 Scientific Societies and Institutions of Great Britain and Ireland.

114 Foreign and Colonial Scientific Establishments, as well as from several private individuals.

Sir Malcolm Fraser, in response to a request to that effect, kindly presented the library with several back numbers of the Meteorological Report for Western Australia; and M. Perrotin also presented the 'Annales' of the Nice Observatory.

Dr. Neumayer has kindly consented to forward regularly the 'Annalen der Hydrographie und Maritimen Meteorologie' of the Deutsche Seewarte, a publication which frequently contains results of magnetic interest.

On re-examining the manuscripts and papers bequeathed to the Observatory by General Sabine, several books of autograph letters written by leading foreign scientific men were found, amongst others letters from Gauss, Lamont, Regnault, Weber, &c.

The card catalogue has been proceeded with, sixty-five cards having been entered during the past year.

Audit, &c.—The accounts for 1895 have been audited by Mr. Keen, Chartered Accountant, on behalf of the Royal Society, and supervised by Mr. Francis Galton, on behalf of the Committee.

The change in the system of book-keeping, referred to in last year's Report, renders impossible the comparison usually made between the expenditure of the year and that of the previous one.

The Observatory has now an account with the London and County Bank only, having closed its account with the Bank of England. This renders it unnecessary to keep so large a cash balance as previously, and as the balance at the end of 1894 was unusually large, the Committee have been enabled to purchase £900 India $3\frac{1}{2}$ per cent. stock.

A small surplus remaining from the Extension Fund, contributed by Mr. Galton for constructing a fence round the Observatory, has been transferred to the general account.

PERSONAL ESTABLISHMENT.

The staff employed is as follows:—

C. Chree, D.Sc., Superintendent.
T. W. Baker, Chief Assistant.
E. G. Constable, Observations and Rating.
W. Hugo, Verification Department.
J. Foster ,, ,,
T. Gunter ,, ,,
W. J. Boxall ,, ,,
E. Dagwell, Observations and Rating.
R. S. Whipple, Accounts and Library, and six other Assistants.
A Caretaker and Housekeeper are also employed.

(Signed) FRANCIS GALTON,
Chairman.

Kew Observatory. Account of Receipts and Payments for the year ending December 31st, 1895.

Dr. RECEIPTS.

	£	s.	d.	£	s.	d.
To Balance from Year 1894				1051	7	4
Royal Society:—						
Gassiot Trust. Annual payment	444	1	4			
,, ,, Income tax returned	40	8	8			
				484	10	0
Meteorological Council:—						
Allowance	400	0	0			
Postages, &c.	7	14	10			
				407	14	10
Researches:—						
Meteorological Council	6	14	9			
Government Grant Committee	100	0	0			
				106	14	9
Tests:—						
Verifications	1434	10	5			
Rating	561	9	2			
Lenses	8	10	2			
				2004	9	9
Commissions executed for Colonial and Foreign Institutions, &c.				310	8	3
Rents				2	3	0
Dividends on India Stock				10	3	0
				£4377	10	11

PAYMENTS. *Cr.*

	£	s.	d.	£	s.	d.
By Normal Observatory:—						
Salaries—Observations, Tabulations, &c.	351	19	6			
Incidental Expenses, Instruments, &c.	56	9	3			
Proportion of Administration Expenditure	108	0	0			
				516	8	9
Researches:—						
Purchase of Apparatus	75	19	1			
Construction of Platinum Thermometer Room	123	14	6			
Proportion of Administration Expenditure	216	0	0			
				415	13	7
Tests:—						
Salaries	797	4	6			
Incidental Expenses—Instruments, Postages, &c.	167	15	3			
Proportion of Administration Expenditure	648	5	4			
				1613	5	1
Commissions:—						
Purchase of Instruments and Photographic Paper for Colonial and Foreign Institutions, &c.	269	11	3			
Proportion of Administration Expenditure	108	0	0			
				377	11	3
Extension Fund:—						
Construction of Fence (balance of contract) and new roadway				74	0	0
Purchase of £900 India 3½ per cent. Stock				1039	4	6
Balance in London and County Bank	331	0	4			
Cash in hand	10	7	5			
				341	7	9
				£4377	10	11

Audited and found correct on behalf of the Royal Society.
13th of January, 1896.
(Signed) W. B. KEEN, *Chartered Accountant.*

Supervised on behalf of the Committee and approved.
14th January, 1896.
(Signed) FRANCIS GALTON.

ADMINISTRATION EXPENDITURE.

Particulars.

	£	s.	d.
Superintendent	400	0	0
First Assistant and Librarian	381	16	0
Rent, Fuel, &c.	88	18	11
Caretaker, Repairs, &c.	209	10	5
	£1080	5	4

Apportionment.

	£.	s.	d.
Observatory	108	0	0
Researches	216	0	0
Tests	648	5	4
Commissions	108	0	0
	£1080	5	4

ESTIMATED ASSETS.

	£	s.	d.	£	s.	d.
By Balance as per Statement				341	7	9
£900 India 3½ per cent. Stock, value on January 1, 1896				1053	0	0
Payments due:—						
Meteorological Council—Allowance, Postages, &c.	118	13	1			
Test Fees	638	19	4			
Commissions	39	18	6			
				797	10	11
Stock:—						
Blank Forms and Certificates	52	16	8			
Standard Thermometers	79	14	6			
				132	11	2
				£2324	9	10

January 16th, 1896.

ESTIMATED LIABILITIES.

	£	s.	d.	£	s.	d.
To Administration accounts—Gas, Repairs, &c.				38	6	7
Observatory accounts—Photographic Paper, &c.				7	2	5
Tests accounts—Fittings, Printing, &c.				29	5	0
Researches account—Instruments, &c.	115	11	9			
,, ,, Building of Platinum Thermometer Room	11	17	0			
				127	8	9
Commissions				19	8	3
General Balance				2102	17	10
				£2324	9	10

(Signed) CHARLES CHREE,
Superintendent.

List of Instruments, Apparatus, &c., the Property of the Kew Observatory Committee, at the present date out of the custody of the Superintendent, on Loan.

To whom lent.	Articles.	Date of loan.
G. J. Symons, F.R.S.	Portable Transit Instrument	1869
The Science and Art Department, South Kensington.	Articles specified in the list in the Annual Report for 1893.....	1876
Professor W. Grylls Adams, F.R.S.	Unifilar Magnetometer, by Jones, No. 101, complete.....	1883
	Pair 9-inch Dip-Needles with Bar Magnets ...	1887
Lord Rayleigh, F.R.S.	Standard Barometer (Adie, No. 655)	1885
The "Jackson-Harmsworth" Polar Expedition.	Unifilar Magnetometer, by Jones, marked N.A.B.C., complete. Dip-Circle, by Barrow, with two Needles and Bar Magnets. Two Tripod Stands	1894

APPENDIX I.

Magnetical Observations, 1895.

Made at the Kew Observatory, Old Deer Park, Richmond, Lat. 51° 28′ 6″ N. and Long. $0^h\ 1^m\ 15^s{\cdot}1$ W.

The results given in the following tables are deduced from the magnetograph curves which have been standardised by observations of deflection and vibration. These were made with the Collimator Magnet K.C. I. and the Declinometer Magnet marked K.O. 90 in the 9-inch Unifilar Magnetometer by Jones.

The Inclination was observed with the Inclinometer by Barrow, No. 33, and needles 1 and 2, which are $3\frac{1}{2}$ inches in length.

The Declination and Force values given in Tables I to VIII are prepared in accordance with the suggestions made in the fifth report of the Committee of the British Association on comparing and reducing Magnetic Observations.

The following is a list of the days during the year 1895 which were selected by the Astronomer Royal, as suitable for the determination of the magnetic diurnal inequalities, and which have been employed in the preparation of the magnetic tables :—

January	5, 13, 25, 26, 27.
February	4, 13, 22, 25, 26.
March	7, 11, 12, 24, 27.
April.....	2, 8, 21, 22, 29.
May	4, 12, 16, 19, 23.
June.....	8, 13, 14, 15, 26.
July	3, 7, 19, 24, 25.
August.....	2, 3, 7, 22, 27.
September	2, 7, 8, 21, 28.
October.....	3, 10, 18, 21, 22.
November	7, 14, 17, 19, 21.
December.....	4, 5, 6, 16, 29.

Table I.—Hourly Means of Declination, as determined from the

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
	(17° +) West					Winter.						
1895. Months.	′	′	′	′	′	′	′	′	′	′	′	′
Jan. ..	18·3	18·6	19·0	19·2	19·4	19·4	19·2	18·8	18·7	18·9	19·5	20·2
Feb. ..	17·1	17·7	17·8	18·2	17·8	17·5	17·2	17·6	17·9	17·2	18·4	20·6
March.	17·2	17·1	17·2	17·2	17·3	16·9	16·3	15·7	14·4	14·4	16·6	20·0
Oct. ..	14·4	14·2	14·0	14·0	14·2	13·5	13·4	13·3	12·6	12·6	14·8	17·7
Nov. ..	12·8	13·3	13·5	13·8	14·1	13·9	13·4	13·6	13·0	12·5	13·8	15·2
Dec. ..	13·4	13·8	13·9	13·9	13·7	13·7	13·6	13·3	13·1	13·2	14·7	15·7
Mean	15·5	15·8	15·9	16·0	16·1	15·8	15·5	15·4	14·9	14·8	16·3	18·2
						Summer.						
	′	′	′	′	′	′	′	′	′	′	′	′
April..	17·3	17·2	17·0	16·3	16·0	15·5	14·8	13·5	13·4	14·6	17·3	20·7
May ..	16·7	16·1	15·4	15·8	14·9	13·8	13·3	13·0	13·8	15·1	18·0	21·3
June ..	15·0	14·8	14·3	13·9	13·1	11·6	9·9	8·8	9·6	11·5	14·5	18·6
July ..	15·7	15·8	15·5	15·1	14·6	13·9	12·1	11·6	12·1	13·7	15·5	19·0
Aug. ..	15·5	15·0	14·4	14·3	13·6	12·2	11·9	11·7	12·2	13·8	16·1	19·1
Sept...	15·4	15·5	15·8	15·4	15·1	14·4	13·5	12·4	12·0	13·0	15·1	18·0
Mean	15·9	15·7	15·4	15·1	14·5	13·6	12·6	11·8	12·2	13·6	16·1	19·4

Table II.—Diurnal Inequality of the Kew

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
						Summer Mean.						
	′	′	′	′	′	′	′	′	′	′	′	′
	−1·0	−1·2	−1·5	−1·8	−2·4	−3·3	−4·3	−5·1	−4·7	−3·3	−0·8	+2·5
						Winter Mean.						
	′	′	′	′	′	′	′	′	′	′	′	′
	−1·2	−0·9	−0·8	−0·7	−0·6	−0·9	−1·2	−1·3	−1·8	−1·9	−0·4	+1·5
						Annual Mean.						
	′	′	′	′	′	′	′	′	′	′	′	′
	−1·1	−1·1	−1·2	−1·2	−1·5	−2·1	−2·8	−3·2	−3·2	−2·6	−0·6	+2·0

Note.—When the sign is + the magnet

selected quiet Days in 1895. (The Mean for the Year = 17° 16′·8 west.)

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
					Winter.							
′	′	′	′	′	′	′	′	′	′	′	′	′
20·5	21·2	20·7	20·3	20·5	20·2	19·6	19·3	18·9	18·3	18·4	18·4	18·9
22·2	23·0	23·0	22·0	20·5	19·8	19·7	19·2	18·5	18·0	17·7	17·6	17·2
22·7	24·3	24·5	22·0	20·4	19·1	18·5	17·8	17·6	17·6	17·6	17·0	17·0
19·7	20·2	18·9	17·9	16·1	15·5	15·4	15·1	14·7	14·4	14·4	14·2	13·9
16·5	16·9	16·6	16·2	15·4	15·0	14·9	14·2	13·9	13·4	12·6	13·0	12·6
16·6	16·9	15·9	15·7	14·8	14·4	13·7	13·4	13·0	13·0	13·1	13·4	13·4
19·7	20·4	19·9	19·0	17·9	17·3	17·0	16·5	16·1	15·8	15·6	15·6	15·5
					Summer.							
′	′	′	′	′	′	′	′	′	′	′	′	′
24·2	25·7	25·3	23·6	21·6	19·2	18·4	18·3	18·4	18·4	18·2	17·7	17·1
23·6	24·0	23·1	21·7	20·0	19·0	18·1	17·5	17·1	17·2	17·0	16·5	15·8
22·0	23·5	23·7	22·8	21·5	19·5	18·0	16·9	16·3	16·1	16·3	15·7	15·3
22·1	24·1	24·2	22·2	20·4	19·1	18·5	18·1	17·6	17·5	17·4	16·8	16·5
22·3	23·9	22·9	20·1	17·7	16·2	15·8	15·9	16·1	15·6	15·9	15·9	15·2
20·9	22·0	20·7	19·2	17·3	16·0	15·2	15·4	15·3	15·4	15·2	15·3	15·3
22·5	23·9	23·3	21·6	19·7	18·2	17·3	17·0	16·8	16·7	16·7	16·3	15·9

Declination as derived from Table I.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
					Summer Mean.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+5·6	+7·0	+6·4	+4·7	+2·8	+1·3	+0·4	+0·1	−0·1	−0·2	−0·2	−0·6	−1·0
					Winter Mean.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+3·0	+3·7	+3·2	+2·3	+1·2	+0·6	+0·3	−0·2	−0·6	−0·9	−1·1	−1·1	−1·2
					Annual Mean.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+4·3	+5·3	+4·8	+3·5	+2·0	+0·9	+0·3	−0·1	−0·4	−0·6	−0·7	−0·9	−1·1

points to the west of its mean position.

Table III.—Hourly Means of the Horizontal Force in C.G.S. units (corrected
(The Mean for the

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
	0·18000 +					Winter.						
1895. Months.												
Jan. ..	267	266	269	270	271	273	276	276	272	267	264	262
Feb. ..	274	274	275	275	277	279	281	279	277	271	263	261
March.	278	275	278	278	278	279	278	276	270	259	250	250
Oct. ..	278	275	274	275	276	277	275	274	267	259	252	252
Nov. ..	268	271	274	274	274	277	278	278	275	268	262	260
Dec. ..	282	283	285	287	290	290	292	291	288	283	280	275
Mean	275	274	276	277	278	279	280	279	275	268	262	260
						Summer.						
April..	285	284	282	280	278	278	276	269	261	250	237	238
May ..	288	287	282	280	280	279	277	271	262	256	252	256
June ..	290	288	285	286	285	283	279	270	261	256	251	256
July ..	298	295	295	295	292	289	284	279	272	264	260	260
Aug. ..	291	290	288	285	285	283	279	274	265	259	254	256
Sept. ..	279	279	279	279	279	280	279	273	263	255	252	255
Mean	289	287	285	284	283	282	279	273	264	257	251	254

Table IV.—Diurnal Inequality of the Kew

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
						Summer Mean.						
	+ ·00008	+ ·00006	+ ·00004	+ ·00003	+ ·00002	+ ·00001	− ·00002	− ·00008	− ·00017	− ·00024	− ·00030	− ·00027
						Winter Mean.						
	·00000	− ·00001	+ ·00001	+ ·00002	+ ·00003	+ ·00004	+ ·00005	+ ·00004	·00000	− ·00007	− ·00013	− ·00015
						Annual Mean.						
	+ ·00004	+ ·00003	+ ·00003	+ ·00003	+ ·00003	+ ·00003	+ ·00002	− ·00002	− ·00008	− ·00015	− ·00022	− ·00021

Note.—When the sign is + the

for Temperature) as determined from the selected quiet Days in 1895. Year = 0·18278.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
Winter.												
262	265	267	268	266	268	270	271	269	271	271	271	272
266	270	273	276	275	277	282	283	285	285	283	281	281
255	261	266	271	273	276	279	280	283	284	284	283	283
259	266	270	273	273	276	279	278	278	279	279	280	283
263	266	271	274	275	279	278	280	279	278	276	275	274
277	279	278	280	282	282	285	285	284	284	285	286	285
264	268	271	274	274	276	279	280	280	280	280	279	280
Summer.												
252	261	271	277	283	285	289	289	291	292	292	292	289
267	276	279	285	291	295	298	301	297	293	291	291	289
267	274	286	292	298	302	304	305	305	306	300	298	296
269	281	291	297	300	304	308	308	307	307	306	305	304
266	275	284	285	285	285	290	294	296	294	290	292	290
264	272	275	277	277	281	283	286	286	285	286	286	285
264	273	281	286	289	292	295	297	297	296	294	294	292

Horizontal Force as deduced from Table III.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
Summer Mean.												
−·00017	−·00008	·00000	+·00005	+·00008	+·00011	+·00014	+·00016	+·00016	+·00015	+·00013	+·00013	+·0001
Winter Mean.												
−·00011	−·00007	−·00004	−·00001	−·00001	+·00001	+·00004	+·00005	+·00005	+·00005	+·00005	+·00004	+·00005
Annual Mean.												
−·00014	−·00007	−·00002	+·00002	+·00004	+·00006	+·00009	+·00011	+·00011	+·00010	+·00009	+·00009	+·00008

reading is above the mean.

Table V.—Hourly Means of the Kew Vertical Force in C.G.S. units (corrected
(The Mean for the

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
	0·43000 +					Winter.						
1895. Months.												
Jan. ..	895	895	894	894	895	895	895	894	893	892	890	889
Feb. ..	941	939	937	938	937	936	936	937	938	937	934	930
March .	931	933	932	931	931	932	932	935	936	931	926	923
Oct. ..	845	847	848	849	852	853	853	854	856	854	848	846
Nov. ..	842	841	841	840	840	840	839	838	839	837	833	835
Dec. ..	890	890	890	889	890	889	888	886	886	884	882	883
Mean	891	891	890	890	891	891	891	891	891	889	886	884
						Summer.						
April ..	924	924	923	924	926	927	929	929	926	921	915	909
May ..	932	932	932	935	937	939	939	939	935	929	923	918
June ..	902	901	902	905	908	911	910	908	903	897	890	885
July ..	934	934	934	934	936	938	938	936	932	927	923	918
Aug. ..	915	915	914	916	916	918	917	916	914	909	901	900
Sept. ..	875	876	877	879	880	882	884	885	882	878	871	867
Mean	914	914	914	916	917	919	920	919	915	910	904	900

Table VI.—Diurnal Inequality of the Kew

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
						Summer Mean.						
	+ ·00002	+ ·00002	+ ·00002	+ ·00004	+ ·00005	+ ·00007	+ ·00008	+ ·00007	+ ·00003	− ·00002	− ·00008	− ·00012
						Winter Mean.						
	+ ·00001	+ ·00001	·00000	·00000	+ ·00001	+ ·00001	+ ·00001	+ ·00001	+ ·00001	− ·00001	− ·00004	− ·00006
						Annual Mean.						
	+ ·00001	+ ·00001	+ ·00001	+ ·00002	+ ·00003	+ ·00004	+ ·00004	+ ·00004	+ ·00002	− ·00002	− ·00006	− ·00009

NOTE.—When the sign is + the

for Temperature), as determined from the selected quiet Days in 1895. Year = 0·43901.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
						Winter.						
889	889	892	891	891	893	894	894	893	892	891	890	889
928	928	933	937	938	941	939	939	938	937	937	937	937
921	923	927	931	934	933	931	930	929	929	930	927	927
845	849	853	859	862	862	861	861	861	860	860	859	859
835	837	841	843	843	842	840	839	839	837	837	838	838
884	886	890	890	891	891	890	889	887	886	885	885	885
884	885	889	892	893	894	893	892	891	890	890	889	889
						Summer.						
908	910	916	924	927	927	928	925	925	924	923	922	921
913	916	924	932	936	940	942	941	940	939	939	938	937
882	883	889	894	899	902	904	905	903	902	900	899	898
916	920	929	933	936	940	938	937	935	934	932	931	931
897	900	905	915	918	918	917	915	914	914	912	913	912
866	870	875	878	879	880	878	877	875	874	874	874	874
897	900	906	913	916	918	918	917	915	914	913	913	912

Vertical Force as deduced from Table V.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
						Summer Mean.						
−·00015	−·00012	−·00006	+·00001	+·00004	+·00006	+·00006	+·00005	+·00003	+·00002	+·00001	+·00001	·00000
						Winter Mean.						
−·00006	−·00005	−·00001	+·00002	+·00003	+·00004	+·00003	+·00002	+·00001	·00000	·00000	−·00001	−·00001
						Annual Mean.						
−·00011	−·00009	−·00003	+·00001	+·00003	+·00005	+·00004	+·00003	+·00002	+·00001	·00000	·00000	−·00001

reading is above the mean.

Table VII.—Hourly Means of the Inclination, calculated from the Horizontal

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
	67° +					Winter.						
1895. Months.	′	′	′	′	′	′	′	′	′	′	′	′
Jan....	24·3	24·4	24·2	24·1	24·1	23·9	23·7	23·7	23·9	24·2	24·4	24·5
Feb....	25·1	25·1	25·0	25·0	24·8	24·7	24·5	24·7	24·8	25·2	25·7	25·7
March.	24·6	24·8	24·6	24·6	24·6	24·5	24·6	24·8	25·3	25·9	26·3	26·2
Oct....	22·2	22·4	22·5	22·5	22·5	22·5	22·6	22·7	23·2	23·7	24·0	24·0
Nov. ..	22·8	22·5	22·3	22·3	22·3	22·1	22·0	22·0	22·2	22·6	22·9	23·1
Dec....	23·2	23·1	23·0	22·8	22·6	22·6	22·5	22·5	22·7	22·9	23·1	23·5
Mean	23·7	23·7	23·6	23·6	23·5	23·4	23·3	23·4	23·7	24·1	24·4	24·5
						Summer.						
	′	′	′	′	′	′	′	′	′	′	′	′
April..	23·9	24·0	24·1	24·3	24·4	24·5	24·7	25·1	25·6	26·2	26·9	26·7
May...	23·9	24·0	24·3	24·6	24·6	24·7	24·9	25·3	25·8	26·0	26·1	25·7
June ..	23·0	23·1	23·3	23·3	23·5	23·7	23·9	24·5	24·9	25·1	25·2	24·8
July...	23·3	23·5	23·5	23·5	23·8	24·0	24·4	24·7	25·0	25·4	25·6	25·4
Aug. ..	23·3	23·3	23·4	23·7	23·7	23·9	24·1	24·4	25·0	25·2	25·4	25·2
Sept. ..	23·0	23·0	23·0	23·1	23·1	23·1	23·2	23·6	24·2	24·7	24·7	24·3
Mean	23·4	23·5	23·6	23·8	23·9	24·0	24·2	24·6	25·1	25·4	25·7	25·4

Table VIII.—Diurnal Inequality of the

Hours	Mid.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
						Summer Mean.						
	′	′	′	′	′	′	′	′	′	′	′	′
	−0·5	−0·4	−0·3	−0·1	0·0	+0·1	+0·3	+0·7	+1·2	+1·5	+1·8	+1·5
						Winter Mean.						
	′	′	′	′	′	′	′	′	′	′	′	′
	0·0	0·0	−0·1	−0·1	−0·2	−0·3	−0·4	−0·3	0·0	+0·4	+0·7	+0·8
						Annual Mean.						
	′	′	′	′	′	′	′	′	′	′	′	′
	−0·2	−0·2	−0·2	−0·1	−0·1	−0·1	0·0	+0·2	+0·6	+1·0	+1·3	+1·2

NOTE.—When the sign is +

and Vertical Forces (Tables III and V). (The Mean for the Year = 67° 23′·8.)

Noon.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
					Winter.							
′	′	′	′	′	′	′	′	′	′	′	′	′
24·5	24·3	24·2	24·1	24·3	24·2	24·1	24·0	24·1	24·0	23·9	23·9	23·8
25·3	25·0	25·0	24·9	25·0	24·9	24·5	24·5	24·3	24·3	24·4	24·6	24·6
25·8	25·5	25·3	25·1	25·0	24·8	24·5	24·4	24·2	24·1	24·2	24·1	24·1
23·5	23·1	22·9	22·9	23·0	22·8	22·6	22·6	22·6	22·5	22·5	22·5	22·3
22·9	22·8	22·5	22·4	22·3	22·0	22·1	21·9	22·0	22·0	22·1	22·2	22·3
23·3	23·3	23·5	23·3	23·2	23·2	23·0	23·0	23·0	22·9	22·8	22·8	22·8
24·2	24·0	23·9	23·8	23·8	23·7	23·5	23·4	23·4	23·3	23·3	23·4	23·3
					Summer.							
′	′	′	′	′	′	′	′	′	′	′	′	′
25·7	25·1	24·6	24·5	24·1	24·0	23·8	23·7	23·5	23·5	23·4	23·4	23·6
24·8	24·3	24·3	24·1	23·9	23·7	23·6	23·3	23·6	23·8	23·9	23·9	24·0
24·0	23·5	22·9	22·6	22·4	22·1	22·1	22·1	22·0	21·9	22·3	22·4	22·5
24·8	24·1	23·7	23·4	23·3	23·1	22·8	22·7	22·8	22·7	22·7	22·8	22·8
24·4	23·9	23·5	23·7	23·8	23·8	23·4	23·1	22·9	23·0	23·3	23·2	23·3
23·7	23·3	23·2	23·2	23·2	23·0	22·8	22·5	22·5	22·5	22·5	22·5	22·5
24·6	24·0	23·7	23·6	23·5	23·3	23·1	22·9	22·9	22·9	23·0	23·0	23·1

Inclination as deduced from Table VII.

Noon	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Mid.
					Summer Mean.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+0·7	+0·1	−0·2	−0·3	−0·4	−0·6	−0·8	−1·0	−1·0	−1·0	−0·9	−0·9	−0·8
					Winter Mean.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+0·5	+0·3	+0·2	+0·1	+0·1	0·0	−0·2	−0·3	−0·3	−0·4	−0·4	−0·3	−0·4
					Annual Mean.							
′	′	′	′	′	′	′	′	′	′	′	′	′
+0·6	+0·2	0·0	−0·1	−0·1	−0·3	−0·5	−0·6	−0·6	−0·7	−0·6	−0·6	−0·6

the reading is above the mean.

APPENDIX Ia.

MEAN VALUES, for the years specified, of the Magnetic Elements at Observatories whose Publications are received at Kew Observatory.

Place.	Latitude.	Longitude.	Year.	Declination.	Inclination.	Horizontal Force. C. G. S. Units.	Vertical Force. C. G. S. Units.
Pawlowsk	59 41 N.	30 29 E.	1893	0 4·4 E.	70 43·9 N.	·16446	·47046
Katharinenburg	56 49 N.	60 38 E.	1893	9 34·6 E.	70 39·1 N.	·17801	·50694
Kasan	55 47 N.	49 8 E.	1892	7 30·8 E.	68 36·2 N.	·18551	·47345
Copenhagen ...	55 41 N.	12 34 E.	1893	10 47·7 W.	68 51·0 N.	·17358	·44868
Stonyhurst	53 51 N.	2 28 W.	1894	18 44·1 W.	69 2·2 N.	·17133	·44719
Hamburg.....	53 34 N.	10 3 E.	1894	11 49·1 W.	67 45·7 N.	·17994	·44009
Wilhelmshaven	53 32 N.	8 9 E.	1892	13 10·1 W.	67 57·3 N.	·17917	·44245
Potsdam	52 23 N.	13 4 E.	1891	10 42·2 W.	66 44·1 N.	·18635	·43342
Irkutsk.....	52 16 N.	104 16 E.	1893	2 9·4 E.	70 9·4 N.	·20117	·55744
Utrecht.....	52 5 N.	5 11 E.	1893	14 28·5 W.	67 12·2 N.	·18397	·43772
Kew.....	51 28 N.	0 19 W.	1895	17 16·8 W.	67 23·8 N.	·18278	·43901
Greenwich*....	51 28 N.	0 0	1894	17 4·6 W.	67 18·7 N. 67 17·3 N.	·18287	·43742 ·43691
Uccle (Brussels)	50 48 N.	4 20 E.	1893	14 48·7 W.	66 28·4 N.	·1877	·4311
Falmouth	50 9 N.	5 5 W.	1894	19 0·8 W.	67 2·4 N.	·18511	·43694
Prague	50 5 N.	14 25 E.	1894	9 36·7 W.	—	·19805	—
Parc St. Maur (Paris)	48 49 N.	2 29 E.	1893	15 21·1 W.	65 7·1 N.	·19621	·42304
Vienna.....	48 15 N.	16 21 E.	1894	8 43·6 W.	63 12.1 N.	·20740	·41061
O'Gyalla (near Buda Pesth)..	—	—	1894	7 58·2 W.	—	·21054	—
Pola (on Adriatic).....	44 52 N.	13 51 E.	1894	9 52·6 W.	60 37·3 N.	·22004	·39086
Nice.....	43 43 N.	7 16 E.	1893	12 32·7 W.	60 26·4 N.	·22198	·39139
Toronto.....	43 40 N.	79 30 W.	1894	4 43·9 W.	74 35·0 N.	·16624	·60286
Perpignan	42 42 N.	2 53 E.	1893	14 10·5 W.	60 11·9 N.	·22304	·38944
Rome...	41 54 N.	12 27 E.	1891	10 45·0 W.	58 4·6 N.	·2324	·3730
Tiflis	41 43 N.	44 48 E.	1893	1 38·0 E.	55 45·7 N.	·25692	·37751
Madrid	40 25 N.	3 40 W.	1893	16 14·2 W.	—	—	—
Coimbra.....	40 12 N.	8 25 W.	1893	17 51·7 W.	59 50·5 N.	·22518	·38752
Washington ...	38 53 N.	77 0 W.	1891	4 9·7 W.	71 5·1 N.	·19855	·57940
Lisbon.....	38 43 N.	9 9 W.	1893	17 49·4 W.	58 24·6 N.	·23270	·37840
Zi-ka-wei	31 12 N.	121 26 E.	1893	2 17·0 W.	45 59·7 N.	·32585	·33736
Hong Kong....	22 18 N.	114 10 E.	1894	0 29·2 E.	31 53·1 N.	·36450	·22675
Colaba.....	18 54 N.	72 49 E.	1894	0 38·6 E.	20 40·7 N.	·37426	·14126
Manila.....	14 35 N.	127 11 E.	1894	0 50·4 E.	16 54·3 N.	·37740	·11470
Batavia	6 11 S.	106 49 E.	1893	1 30·6 E.	29 6·2 S.	·36741	·20451
Mauritius	20 6 S.	57 33 E.	1893	10 2·1 W.	54 44·3 S.	·23989	·33929
Melbourne.....	37 50 S.	144 58 E.	1893	8 9·6 E.	67 17·0 S.	·23432	·55968

* Of the two values of the Inclination and Vertical Force, the first is based on observations with 3-inch dip needles only, the second on combined observations with needles of 3, 6, and 9 inches.

APPENDIX II.—Table I.

Mean Monthly Results of Temperature and Pressure. Kew Observatory.
1895.

Months.	Thermometer.								Barometer.*					Mean vapour-tension.
	Mean.	Means of—			Absolute Extremes.				Mean.	Absolute Extremes.				
		Max.	Min.	Max. and Min.	Max.	Date.	Min.	Date.		Max.	Date.	Min.	Date.	
1895.	°	°	°	°	°	d. h.	°	d. h.	ins.	ins.	d. h.	ins.	d. h.	in.
Jan.....	34·1	37·8	29·7	33·8	51·8	20 2 P.M.	20·6	29 4 A.M.	29·705	30·473	30 6 P.M.	28·943	14 NOON.	·165
Feb. ...	29·4	34·5	23·8	29·2	44·9	28 3 „	10·8	7 7 „	30·098	30·532	17 2 A.M.	29·574	11 5 A.M.	·109
March..	42·8	50·1	36·6	43·4	62·0	22 5 „	26·1	3 8 „	29·750	30·424	15 9 „	28·869	28 NOON.	·221
April...	48·3	55·8	41·6	48·7	64·1	20 1 & 2 „	29·7	1 6 „	29·914	30·403	12 9 „	29·313	7 3 A.M.	·263
May ...	55·3	64·9	45·8	55·4	83·7	30 3 „	36·8	2 4 „	30·087	30·629	2 NOON.	29·574	18 5 „	·296
June...	60·6	70·7	50·5	60·6	80·6	26 2 „	41·8	13 5 „	30·076	30·460	24 11 P.M.	29·625	18 8 P.M.	·340
July ...	62·2	70·6	54·3	62·5	80·4	17 4 „	48·9	7 4 „	29·885	30·278	6 7 A.M.	29·417	20 3 „	·386
Aug....	61·6	69·7	54·1	61·9	77·7	22 3 „	46·4	25 5 „	29·923	30·312	25 11 „	29·325	4 4 A.M.	·420
Sept....	60·5	71·4	51·2	61·3	80·2	24 3 „	38·6	22 6 „	30·153	30·425	21 9 „	29·775	11 4 „	·408
Oct.....	46·0	52·9	38·6	45·8	70·9	1 1 „	25·1	28 6 „	29·855	30·564	18 10 „	29·058	9 6 „	·263
Nov. ...	47·6	52·3	41·7	47·0	61·6	16 1 „	29·9	18 8 „	29·895	30·501	1 7 P.M.	29·143	12 2 P.M.	·279
Dec. ...	40·4	44·5	35·6	40·1	56·2	5 2 „	26·1	11 6 „	29·813	30·451	28 2 A.M.	29·123	16 5 A.M.	·213
Yearly Means	49·1	56·3	42·0	49·1	..	....	..	....	29·930	..	....	..	....	·280

* Reduced to 32° at M.S.L.

This Table is compiled from "Hourly Means," vol. 1895, of the Meteorological Office.

Meteorological Observations.—Table II.

Kew Observatory.

Months.	Mean amount of cloud (0=clear, 10=overcast).	Rainfall.*			Weather. Number of days on which were registered							Wind.† Number of days on which it was								
		Total.	Maximum.	Date.	Rain. ‡	Snow.	Hail.	Thunderstorms.	Clear sky.	Overcast sky.	Gales.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1895.		ins.	ins.																	
January.....	6·5	1·435	0·605	19	17	12	..	1	3	12	0	11	2	2	2	3	3	3	5	4
February....	5·8	0·090	0·040	1	3	3	..	..	8	10	3	6	12	5	1	..	..	2	2	5
March.....	6·7	1·235	0·380	26	17	4	2	..	4	15	2	3	1	1	2	3	11	6	4	3
April.....	7·0	1·625	0·410	24	12	..	..	1	3	13	..	4	4	3	2	2	10	3	2	1
May.....	4·7	0·445	0·125	23	7	1	..	1	13	8	1	8	5	6	2	3	1	2	4	8
June	6·2	0·230	0·155	18	7	..	..	1	5	12	..	5	8	1	2	1	8	3	2	6
July.....	6·8	4·515	0·845	18	11	..	..	2	3	15	..	2	2	1	..	3	13	6	4	5
August	5·5	2·880	1·005	22	17	..	..	3	6	7	..	1	..	..	1	6	13	7	3	8
September...	3·0	1·535	1·385	6	5	..	1	2	19	2	..	2	2	8	2	1	7	5	3	12
October	6·6	3·000	1·405	5	14	..	..	..	2	9	..	4	2	3	1	1	6	11	3	10
November...	7·3	3·405	0·650	28	16	..	..	..	2	16	7	..	2	8	2	5	9	3	1	1
December ...	7·5	1·965	0·325	12	16	3	1	..	3	17	3	1	5	4	2	2	7	8	2	3
Totals and means.	6·1	22·360			142	23	4	11	71	136	16	47	45	42	19	30	88	59	35	66

* Measured at 10 A.M. daily by gauge 1·75 feet above ground.

† As registered by the anemograph.

‡ The number of rainy days are those on which 0·01 inch rain or melted snow was recorded.

Meteorological Observations.—Table III.

Kew Observatory.

Months.	Bright Sunshine.				Maximum temperature in sun's rays. (Black bulb *in vacuo*.)			Minimum temperature on the ground.			Horizontal movement of the air.*		
	Total number of hours recorded.	Mean percentage of possible sunshine.	Greatest daily record.	Date.	Mean.	Highest.	Date. †	Mean.	Lowest.	Date. ‡	Average hourly velocity.	Greatest hourly velocity.	Date.
1895.	h. m.		h. m.		deg.	deg.		deg.	deg.		miles.	miles.	
January	51 18	20	5 36	18	63	83	18	24	13	11, 29	11·4	34	31
February	39 36	14	5 18	16	62	94	28	16	0	8	10·3	38	11
March	116 18	32	10 42	22	96	109	22	31	13	4	11·0	45	24
April	127 12	31	11 54	11	104	128	19	35	23	1, 5	11·2	32	14
May	245 0	51	13 48	11	117	140	30	41	31	2	9·7	35	7
June	235 42	48	14 18	25	128	141	23	44	32	15	7·8	25	6, 7
July	183 24	37	14 18	8	127	139	18	49	40	7, 13	10·2	33	20
August	223 0	50	13 6	21	128	138	21	48	37	25	9·1	29	11, 27
September	214 0	56	11 42	1, 2	118	130	7	44	32	22	5·8	21	11, 29
October	79 0	24	7 24	17, 25	90	122	1	34	16	28	6·9	30	3
November	46 18	17	6 30	13	75	98	14	36	23	3	13·5	46	16
December	31 36	13	5 30	7	62	81	13	30	19	8	13·2	39	5
Totals and Means	1592 24	33	..	..	97	..	..	36	..	..	10·0	..	..

* As indicated by a Robinson's anemograph, 70 feet above the general surface of the ground.

† Read at 10 A.M., and entered to previous day. ‡ Read at 10 A.M., and entered to same day.

Table IV.

Summary of Sun-spot Observations made at the Kew Observatory.

Months.	Days of observation.	Number of new groups enumerated.	Days apparently without spots.
1895.			
January	13	12	—
February	10	14	—
March	17	11	—
April	12	12	—
May	21	15	—
June	15	8	—
July	8	10	—
August	17	14	—
September	17	14	—
October	10	9	—
November	12	10	—
December	7	15	—
Totals for 1895	159	144	—

APPENDIX III.—Table I.

RESULTS OF WATCH TRIALS. Performance of the 59 Watches which obtained the highest number of marks during the year.

Watch deposited by	Number of watch.	Balance spring, escapement, &c.	Mean daily rate.					Mean variation of daily rate. ±	Mean change of rate for 1° F.	Difference between extreme gaining and losing rates.	Marks awarded for			Total Marks.
			Pendant up.	Pendant right.	Pendant left.	Dial up.	Dial down.				Daily variation of rate.	Change of rate with change of position.	Temperature compensation.	
											0—40	0—40	0—20	0—100.
			secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.				
A. E. Fridlander, Coventry	13911	Single overcoil, s.r., g.b. centre seconds ...	−0·6	−1·7	−1·2	+0·5	+0·2	0·4	0·02	5·0	31·4	37·1	18·9	87·4
A. E. Fridlander, Coventry	52761	Single overcoil, d.r., g.b. centre seconds ...	−0·7	−0·8	−1·5	−1·6	−2·4	0·5	0·02	4·7	30·1	37·9	18·5	86·5
Baume & Co., London..... ...	103031	Single overcoil, g.b., "tourbillon" chronometer	+0·1	+0·0	+0·6	−0·1	+4·5	0·4	0·02	6·2	32·8	34·5	18·7	86·0
A. E. Fridlander, Coventry	13762	Single overcoil, s.r., g.b.	+2·3	+1·9	+3·6	+4·5	+2·4	0·5	0·02	5·0	30·7	36·4	18·9	86·0
S. Smith & Son, London.....	8071	Single overcoil, s.r., g.b., "Karrusel".....	+1·2	+0·9	+0·6	+2·3	−2·2	0·4	0·02	6·5	31·3	35·6	18·4	85·3
Jos. White & Son, Coventry	35440	Single overcoil, s.r., g.b., "Karrusel".....	+2·3	+1·5	+2·6	+3·7	+6·4	0·5	0·01	8·0	30·7	35·2	19·3	85·2
S. Yeomans, Coventry.....	71624	Single overcoil, s.r., g.b., "Karrusel".....	+1·7	+1·3	+2·6	+0·3	+3·1	0·6	0·003	5·2	28·4	36·6	19·8	84·8
L. Rozat, Chaux-de-Fonds.....	2365	Single overcoil, g.b., "tourbillon"	+3·0	+3·5	+2·3	+5·7	+2·7	0·5	0·02	6·5	29·1	36·3	19·0	84·4
Carley & Co., London.....	49729	Single overcoil, s.r., g.b., "Karrusel".....	−0·8	−1·4	−1·0	+0·4	+1·4	0·4	0·06	4·3	31·8	36·2	16·3	84·3
T. Russell & Son, Liverpool.....	89361	Single overcoil, s.r., g.b., "Karrusel".....	−0·6	−0·2	−0·2	+1·0	+1·0	0·5	0·05	4·0	30·3	37·4	16·6	84·3
Jos. White & Son, Coventry	35344	Single overcoil, s.r., g.b.	+5·2	+2·4	+1·2	+3·8	+3·2	0·5	0·02	6·7	30·2	35·6	18·5	84·3
A. E. Fridlander, Coventry	14109	Single overcoil, s.r., g.b. centre seconds ...	+2·1	+1·7	+1·0	+0·5	+3·0	0·5	0·04	6·0	30·1	37·1	17·1	84·3
Stauffer, Son, & Co., London.....	157327	Single overcoil, s.r.. g.b., chronograph.....	+4·8	+2·5	+5·0	+3·7	+2·4	0·5	0·03	4·7	30·2	36·1	17·9	84·2
Usher & Cole, London	28342	Single overcoil, s.r., g b. "Karrusel"	+8·5	+9·0	+8·1	+7·1	+9·2	0·5	0·04	6·5	29·1	37·5	17·5	84·1
A. E. Fridlander, Coventry	52899	Single overcoil, s.r., g.b., "Karrusel".....	−0·8	−1·4	−1·0	+1·5	+1·5	0·4	0·05	4·5	31·9	35·1	17·0	84·0
Newsome & Co., Coventry.....	123620	Single overcoil, s.r., g.b., "Karrusel".....	+4·1	+3·9	+3·9	+0·5	+4·1	0·5	0·02	6·5	29·9	35·5	18·6	84·0
Stauffer, Son, & Co., London.....	52525	Single overcoil, s r., g.b., "Karrusel".....	+5·0	+5·5	+5·7	+4·3	+7·1	0·6	0·04	5·0	29·1	37·1	17·6	83·8
Jos. White & Son, Coventry	35365	Single overcoil, s.r., g.b., centre seconds...	+0·3	+0·1	−2·4	+0·4	+0·1	0·5	0·04	4·8	29·5	36·6	17·6	83·7
Usher & Cole, London.....	28341	Single overcoil, s.r., g.b., "Karrusel".....	−1·8	−0·8	−1·0	−1·6	+1·7	0·4	0·07	7·5	31·9	36·2	15·5	83·6
Jos. White & Son, Coventry	34338	Single overcoil, d.r., g.b.	+3·0	+2·4	+4·5	+2·9	+4·3	0·5	0·04	5·0	29·3	36·9	17·2	83·4
Jos. White & Son, Coventry	34843	Single overcoil, s.r., g.b.	−2·6	−0·9	−0·6	−0·6	−0·7	0·6	0·02	5·2	27·3	37·5	18·6	83·4
Jos. White & Son, Coventry	35483	Single overcoil, s.r., g.b.	−1·7	−2·0	−0·9	−2·1	+0·6	0·6	0·03	6·2	28·7	36·6	17·9	83·2
Newsome & Co., Coventry	125317	Single overcoil, s.r., g.b., "Karrusel".....	+0·7	−0·1	−0·2	+2·7	+2·6	0·5	0·04	4·8	30·5	35·2	17·4	83·1
Jos. White & Son, Coventry	35421	Single overcoil, s.r., g.b., "tourbillon" ...	+2·2	+1·6	+1·5	+2·7	+3·5	0·6	0·04	4·5	28·0	37·4	17·7	83·1

Table I—*continued.*

Watch deposited by	Number of watch.	Balance spring, escapement, &c.	Mean daily rate.					Mean variation of daily rate. ±	Mean change of rate for 1° F.	Difference between extreme gaining and losing rates.	Marks awarded for			Total Marks.
			Pendant up.	Pendant right.	Pendant left.	Dial up.	Dial down.				Daily variation of rate.	Change of rate with change of position.	Temperature compensation.	
											0—40	0—40	0—20	0—100.
			secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.				
Usher & Cole, London	28399	Single overcoil, s.r., g.b., "Karrusel"	−2·5	−2·2	−2·6	−0·1	−2·8	0·5	0·05	5·5	29·5	36·9	16·6	83·0
A. E. Fridlander, Coventry	13629	Single overcoil, s.r., g.b., centre seconds	−0·9	−2·1	−4·2	−2·8	−2·4	0·6	0·03	6·5	28·1	36·7	18·0	82·8
A. E. Fridlander, Coventry	14154	Single overcoil, s.r., g.b.	−1·5	+0·4	−1·3	−1·2	−1·2	0·7	0·02	5·0	26·0	37·8	18·5	82·3
S. Smith & Son, London	159—1896	Double overcoil, d.r., g.b. chronograph	+2·3	+4·2	+6·2	+2·5	+3·9	0·6	0·005	7·2	27·1	35·4	19·7	82·2
Newsome & Co., Coventry	124708	Single overcoil, s.r., g.b., "Karrusel"	−2·9	−0·4	−1·2	0·0	−1·7	0·6	0·04	5·2	28·3	36·6	17·2	82·1
A. E. Fridlander, Coventry	52617	Single overcoil, d.r., fusee	+1·7	−0·2	−2·7	+0·4	+2·5	0·5	0·03	7·7	29·4	34·3	18·3	82·0
T. Russell & Son, Liverpool	89360	Single overcoil, s.r., g.b., "Karrusel"	+0·7	+1·4	+1·4	+1·3	+4·6	0·5	0·04	8·0	29·3	35·6	17·1	82·0
V. Kullberg, London	5351	Double overcoil, d.r., g.b.	+2·6	+1·1	+4·3	+2·6	−0·1	0·6	0·02	6·2	28·6	34·9	18·5	82·0
Usher & Cole, London	1512	Single overcoil, s.r., fusee	+0·7	+3·6	+0·5	−0·2	−3·2	0·6	0·003	8·2	28·5	33·7	19·8	82·0
Jos. White & Son, Coventry	35524	Single overcoil, s.r., g.b., "Karrusel"	−1·9	−0·6	−0·4	+1·2	−0·1	0·6	0·04	4·7	27·8	37·1	17·0	81·9
Richardson, Coventry	9455	Single overcoil, s.r., g.b., "Karrusel"	+1·1	+1·9	+2·4	+1·1	+0·2	0·4	0·10	7·7	31·1	37·4	13·2	81·7
R. Crook, London	4445	Double overcoil, s.r., g.b.	+1·9	+5·6	+4·7	+4·1	+1·6	0·5	0·03	7·2	29·2	34·2	18·3	81·7
Jos. White & Co., Coventry	34406	Single overcoil, d.r., g.b.	+1·7	+2·4	−1·3	+2·1	+0·9	0·7	0·01	7·0	26·6	35·6	19·5	81·7
Newsome & Co., Coventry	123622	Single overcoil, s.r., g.b., "Karrusel"	+2·7	+1·6	+2·5	+2·1	+4·7	0·7	0·01	5·7	25·7	36·9	19·1	81·7
John Adams, Coventry	6241	Single overcoil, s.r., g.b., "Karrusel"	−3·9	−2·7	−3·4	−1·6	+1·0	0·5	0·03	8·2	29·3	34·2	18·1	81·6
Jos. White & Son, Coventry	33683	Single overcoil, s.r., g.b., centre seconds	+1·1	+0·9	+0·6	+2·8	+3·5	0·6	0·04	6·0	28·1	35·6	17·7	81·4
Newsome & Co., Coventry	123621	Single overcoil, s.r., g.b., "Karrusel"	+0·8	+0·8	+0·7	+3·8	+2·3	0·6	0·05	5·5	28·9	35·6	16·8	81·3
J. Tripplin, London	95045	Single overcoil, s.r., g.b.	−0·8	+0·4	−3·6	−1·1	−0·4	0·6	0·03	6·2	27·5	36·0	17·7	81·2
Bonniksen, Coventry	52849	Single overcoil, s.r., g.b., "Karrusel"	+0·3	+0·3	+0·8	+4·9	+1·9	0·6	0·03	6·8	28·6	34·4	18·0	81·0
Stauffer, Son, & Co., London	157325	Single overcoil, s.r., g.b., chronograph	+2·6	+3·8	+0·9	+4·2	+1·7	0·6	0·03	6·0	27·2	35·6	18·1	80·9
S. Smith & Son, London	36693	Double overcoil, d.r., g.b., repeater	−2·1	−4·0	−2·7	+1·2	−3·3	0·5	0·05	7·5	29·2	34·5	17·0	80·7
John Adams, Coventry	6166	Single overcoil, s.r., g.b., "Karrusel"	+9·2	+9·3	+8·6	+6·7	+8·5	0·6	0·08	8·5	28·9	37·2	14·6	80·7
C. J. Hill, Coventry	149006	Single overcoil, s.r., g.b., "Karrusel"	+1·7	+3·0	+3·5	+4·3	+6·2	0·6	0·05	6·7	28·6	35·2	16·9	80·7
A. E. Fridlander, Coventry	52897	Single overcoil, d.r., g.b., "Karrusel"	−0·3	+0·5	+0·7	−0·7	−2·7	0·5	0·10	6·2	30·7	36·2	13·7	80·6
A. E. Fridlander, Coventry	52631	Single overcoil, d.r., g.b.	+2·5	+3·2	+0·6	+2·9	+1·0	0·6	0·05	5·0	28·2	36·0	16·4	80·6
C. J. Hill, Coventry	149172	Single overcoil, s.r., g.b., "Karrusel"	+1·2	+0·6	+0·8	+2·3	+3·9	0·7	0·02	5·2	26·3	35·7	18·5	80·5

Table I—*continued.*

Watch deposited by	Number of watch.	Balance spring, escapement, &c.	Mean daily rate.					Mean variation of daily rate. ±	Mean change of rate for 1° F.	Difference between extreme gaining and losing rates.	Marks awarded for			Total Marks.
			Pendant up.	Pendant right.	Pendant left.	Dial up.	Dial down.				Daily variation of rate.	Change of rate with change of position.	Temperature compensation.	
											0—40	0—40	0—20	0—100.
			secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.				
C. J. Hill, Coventry.....	149005	Single overcoil, s.r., g.b., "Karrusel".....	−1·3	−2·4	−2·2	+1·8	+2·3	0·5	0·04	7·2	30·9	32·3	17·2	80·4
Jos. White & Son, Coventry.....	35159	Single overcoil, s.r., g.b.	+2·0	−0·1	−0·8	+3·2	+0·3	0·5	0·06	6·2	29·7	34·6	16·1	80·4
J. Player & Son, Coventry	35245	Single overcoil, d.r., g.b., "Karrusel".....	+1·5	+2·6	+2·3	+1·5	+0·3	0·6	0·03	6·0	27·3	37·4	15·7	80·4
A. E. Fridlander, Coventry	52812	Single overcoil, d.r., g.b.	−0·1	+2·5	−0·3	+0·3	+5·9	0·5	0·03	8·5	30·0	32·1	18·2	80·3
A. E. Fridlander, Coventry	13819	Single overcoil, s.r., g.b.	−1·9	−1·0	−1·5	+1·7	−3·6	0·7	0·02	7·2	26·6	34·8	18·9	80·3
A. E. Fridlander, Coventry	52866	Single overcoil, d.r., g.b.	−3·2	−2·2	−3·9	−2·9	−4·6	0·6	0·09	6·7	28·9	37·2	14·1	80·2
T. Russell & Son, Liverpool	89326	Single overcoil, s.r., g.b., "Karrusel"	−5·4	−3·6	−2·5	−1·5	−2·2	0·6	0·06	5·0	27·2	37·2	15·8	80·2
Jos. White & Son, Coventry.....	35343	Single overcoil, s.r., g.b.	+0·7	−1·5	+1·8	+2·4	+1·8	0·6	0·05	6·7	27·9	35·4	16·8	80·1
Rotherhams, Coventry	17170	Single overcoil, s.r. g.b., chronograph	−2·0	−0·4	−3·7	−1·2	−1·3	0·6	0·05	6·5	27·1	36·4	16·6	80·1

In the above List, the following abbreviations are used, viz.:—s.r. for single roller; d.r. for double roller; g.b. for going barrel; + for gaining rate; − for losing rate.

Table II.

Highest Marks obtained by Complicated Watches during the year.

Description of watch.	Number.	Received from.	Marks awarded for			Total marks, 0—100.
			Variation. 0—40	Position. 0—40	Temperature. 0—20	
Minute chronograph and minute repeater.....	2180	H. Golay, London	31·3	31·9	16·1	79·3
„ „ „	2107	„ „	26·8	32·6	19·1	78·5
Minute and split seconds chronograph	159—1896	S. Smith and Son, London....	27·1	35·4	19·7	82·2
„ „ „	17170	Rotherham and Sons, Coventry	27·1	36·4	16·6	80·1
„ „ „	1896	S. Smith and Son, London....	26·9	34·9	17·9	79·7
„ „ „	3163	Baume and Co., London.....	28·7	35·1	15·8	79·6
„ „ „	3265	„ „ „	26·0	38·2	15·3	79·5
Minute and seconds chronograph	157327	Stauffer, Son, and Co., London	30·2	36·1	17·9	84·2
„ „ „	157325	„ „ „	27·2	35·6	18·1	80·9
„ „ „	52896	Fridlander, Coventry	27·9	34·9	14·9	77·7
„ „ „	157324	Stauffer, Son, and Co., London	25·1	35·4	17·1	77·6
Minute repeater.....	36693	S. Smith and Son, London....	29·2	34·5	17·0	80·7
„ „	3041	H. Golay, London	23·9	34·4	17·5	75·8
"Non-magnetic" watches.....	35505	Fridlander, Coventry	28·5	32·2	15·3	76·0
„ „	229—4	S. Smith and Son, London....	24·1	32·6	16·3	73·0
„ „	159—1895	„ „ „	23·7	32·7	16·5	72·9